DIAMOND THIN FILM CAPACITORS DEMONSTRATE LARGE CAPACITANCE/HIGH TEMPERATURE CAPABILITY

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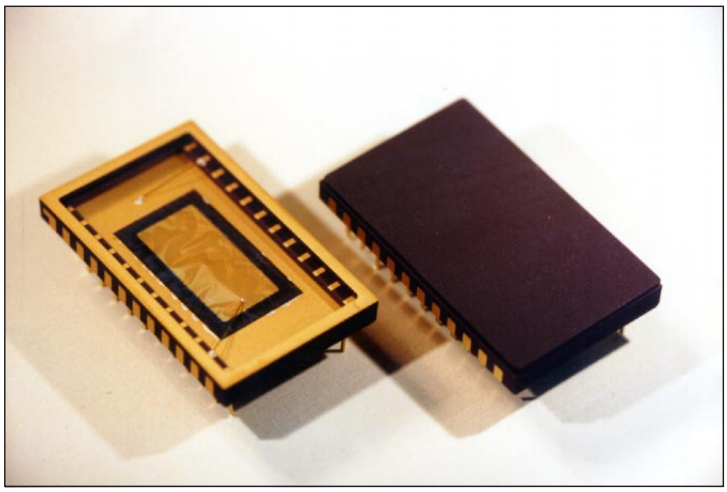

Payoff

The high temperature capabilities of diamond thin film capacitors will enable high temperature electrically driven aircraft accessories such as engine mounted actuators to replace hydraulic engine actuators and remotely mounted flight control actuators, as envisioned for a More Electric Aircraft. Employing diamond capacitor technology in today's aircraft electrical power conversion equipment would double the equipment's reliability.

Accomplishment

The Propulsion Directorate invented a concept that involves producing dielectric capacitor devices by depositing thin layers of diamond film. Using improved fabrication processes, multilayer polycrystalline diamond (PCD) and diamond-like carbon (DLC) capacitors were produced. These diamond capacitors demonstrated a capacitance that is 5 orders of magnitude greater than that achieved with previous diamond capacitors within the same volume. When compared to polymer capacitors used in today's aircraft electrical power conversion equipment, PCD and DLC capacitors offer a 40 percent decrease in size, weight and volume along with a 5 fold increase in temperature capability and a 7 fold increase in energy density.

Background

Capacitors are a critical component in nearly every military and commercial high performance system. High temperature, high energy density capacitors are used by military and commercial aircraft manufacturers, power supply manufacturers, the medical industry and power utilities. The objective of the diamond thin film capacitor development program was to fabricate capacitors of PCD and DLC films for high temperature and high voltage applications that were superior to state-of-the-art devices. Diamond has unique properties such as a high dielectric strength, very high resistivity, high temperature stability, high thermal conductivity, exceptional mechanical strength and chemical inertness. These properties make it attractive for use in advanced power management and distribution systems where temperatures above 300 degrees centigrade are expected. The PCD capacitors were produced using an improved chemical vapor deposition process while the DLC capacitors were produced using an improved ion-beam deposition process. Research will continue to even further improve the diamond thin film capacitors by increasing resistivity and the deposition rates.